Final Conclusions and Comments on the Draft Technical Document:

"Technical document to support the Central Everglades Planning Project Everglades Agricultural Area A-2 Reservoir Water Reservation."

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General Remarks:

This report follows up on our initial review of the technical document. Dong Yoon Lee were very helpful in addressing the comments that we made on the original draft document. Our comments below state our conclusions and contain a few additional comments. In the comments below, the individual peer reviewers, DLD and NJD, are identified, but both reviewers agree with all of the comments.

Hydrologic Evaluations:

In the initial evaluation of the Technical document of the C240 EAA Reservoir Water Reservation it was noted (by NJD) that the procedure of analyzing hydrologic change was good overall, but in a few cases the ponding depth and other hydrological evaluations were difficult to understand. In particular I (NJD) could not tell what sort of wetland would be made in NESRS nor how deep the water would become in E and SE WCA 3A; the ponding depth evaluations (gauge vs. IR) gave either different impressions or were spatially limited. In the public presentation on 29 May the SFWMD addressed this confusion and presented some direct comparisons of existing and projected (EAA Reservoir) hydrological conditions for several regions against one another. The new presentations were helpful and NJD was satisfied that the ponding depths in NESRS would be more like the intact ridge slough system (central WCA 3A) rather than the over-ponded reaches of SE WCA 3A.

The SFWMD presentation of hydrological conditions in SE WCA 3A was expanded, beyond the presentation in the document, to cover projected hydrologic conditions in a couple additional regions. This allowed clarity about depths near the Miami Canal and hydroperiods in the eastern and western portions of SRS. It also addressed the projected shifts in SE WCA 3A more comprehensively; the conditions created by the EAA Reservoir will make average depths slightly deeper but will bring the annual peak levels down. This is an important, though modest expected benefit for protection of the remaining ridges and tree islands.

In the SFWMD presentation they also directly compared the projected hydrologic conditions in northern WCA 3A (west and east) to central WCA 3A and the evaluations looked favorable and considerable ecological benefit can be expected in those northern parts of the system.

During the presentation period the SFWMD also responded to the concerns about WCA 3B. The general evaluation of hydroperiods, what was Fig. 4-2 in the original report, was replaced by a new figure in the public presentation that demonstrated hydroperiod shifts for a longer period of record than just an average or dry year. The updated figure clarified some small benefits of lengthened hydroperiods and deeper water in WCA 3B (south and central). The problem caused by additional drying out northern WCA 3B was acknowledged and discussed as an area for adaptive management and/or a future project.

<u>Remaining suggestions/concerns</u>-

The final document should make the summary comparisons of hydrological conditions across regions explicit. Pointing out the increased averages (Northern WCA 3A), decreased highs (SE WCA 3A) and the similarity of some regions to central WCA 3A helps to justify the benefit to the Ridge-Slough landscape and the associated fish and wildlife. It was not completely clear whether the hydrological contrasts came from indicator regions or gauges and that should be stated in the figure legends in the document.

The primary small benefit in SE WCA 3A is just to bring down the annual peak levels and that should be noted. Overall it seems the ecological benefits are somewhat marginal because averages will still be higher and the effects on foraging wading birds are net negative. Along with the over-dry conditions in WCA 3B, the conditions in SE WCA 3A should be an area considered for continued adaptive management in the future, consistent with the discussion we had with the SFWMD scientists during the public meeting.

After the presentation I (NJD) was also concerned about the way the hydrological situation in western SRS was characterized as "historically high water (slide 48 in the presentation)." It appears that it can only be characterized as high water from a CSSS perspective (i.e., a bird that needs seasonally low water conditions) whereas it does not seem that it could be considered historically high if we took a long-term wetland ecology perspective on the hydrological conditions in western SRS (McVoy et al. 2011; sloughs just north and east of the Ochopee marl marsh). Furthermore, from a multispecies, wetland fish and wildlife perspective (the broader focus of this review of the Water Reservation) it does not appear that the western SRS can be considered high. I suggest that the conflict of characterization should be acknowledged somewhere in this final report.

Phosphorus

We understand, as was noted in the public hearing, that the statutory authority granted to the SFWMD's Governing Board under Chapter 3763.223(4), Florida Statutes, is limited to the protection of fish and wildlife and public health and safety, so does not extend to the issue of phosphorus.

Nonetheless, DLD had questions on the original technical document regarding phosphorus in the Central Everglades. One question regarded the allowable concentration released through the STAs. This was answered that the STAs are sized and operated to meet a long term flow-weighted mean average of 13 ppb phosphorus. The Water Quality-based Effluent Limitation (WQBEL) standard for STA operations allows individual years to exceed this value up to 19 ppb in a single year.

A second question was whether release of water into northern WCA-3A may lead to some phosphorus mobilization, which could affect the vegetation community, though how much might be released is unknown. The response was that the section will be rewritten to note that NW and NE benefits are similar with regard to increased ponding and reduced amount of time water is below 0, and that all over-drained areas subject to soil oxidation have some risk of nutrient

release upon rehydration. The area at greatest risk of phosphorus release are likely closest to central WCA-3A in close proximity to the Miami canal, where increases in phosphorus per unit volume occurred.

Overall, the risks associated with some increased phosphorus input with increased flow and rehydration of some locations are low compared to the benefits of the project.

B. Ecological Evaluations

General:

In our original peer review of the performance metrics we were confused about the ways the ecological evaluations were being made and our concerns broke down to:

1) How the net systemwide benefits were being summarized and expressed (acres or % rise in indices),
2) Why the evaluations were done on average years vs. for long periods of record,
3) Why evaluations were only conducted in relative terms (i.e., change from existing), and
4) A general desire for more explanation of the models and attempts to explain for some of the unexpected projections.

In the public presentation on 29 May the SFWMD addressed all four issues. The first issue was addressed directly by explanation of some of the the aggregated terms. The second was explained as a limitation, the evaluation years are simply the type of evaluation they can receive from the USGS Joint Ecosystem Modelling JEM) lab. The third issue was addressed by showing existing conditions in absolute indices or abundances along with the relative change. The fourth concern was partially addressed for wading birds by digging into the model to explain some of the systemwide responses. The additional explanation and materials provided after the public presentation produced some clarification but also some additional confusion about the metrics used to summarize responses. Our concerns about the fish, wading bird, and apple snail metrics are mentioned below in each section.

Wading birds:

In my (NJD) original evaluation of the responses in WCA 3B it appeared that model projected a response of storks that could not be synthesized with the hydrologic and fish responses (i.e., marginal changes in hydrologic conditions and no changes in the fish). The public presentation still showed basically no response of the fish, except in dry years, but the hydrologic change in southern and central WCA 3B was clarified so that I could make better sense of the benefits to storks in that region.

In our first evaluation we had confusion about the summary of the expected response of the wading birds overall (systemwide) and to the conditions in eastern WCA 3A (i.e., why were they negative). We discussed the overall negative response of storks and small systemwide improvement for ibises. Part of the loss to wading bird foraging habitat overall was purported to have been caused by lots of wetland landscape (lots of grid cells) in the southern part of ENP

with small % losses in quality. We are not sure what that means hydrologically, but that produced a bit of uncertainty. The conditions causing negative scores in eastern WCA 3A also could not be fully evaluated by the time of the public presentation.

Remaining concerns -

The overall benefit to the wading birds was rather modest and the reason for the decreased foraging habitat quality in southern ENP and eastern WCA 3A should be addressed to some degree in order to determine the hydrological reasons for the offsets. It was noted (DLD) that the eastern WCA 3A area is also poor habitat for apple snails in all of the evaluations in Darby et al. (2015). This suggests that it might be too deeply flooded almost all of the time. On the other hand, the maps of apple snail population number subsequently supplied by Dong Yoon Lee show substantial apple snail populations occurring only during the wet year (1995), which might suggest that the area may be too dry ordinarily. Although our guess is that the SE WCA 3A is too deeply ponded, it would be good to get clarification of what the hydrologic conditions of this area are.

The maps of white ibis and wood stork in the draft document (Figures 4-39a,b) show only the differences C240-EARECB. After the public meeting, maps of the individual EARECB and C240 maps for the two species were provided. However, the individual EARECB and C240 maps have poor resolution, so it is difficult to distinguish variations of habitat quality. The maps show what seems to be reasonably good conditions for both wading birds over most of the area, so it may be that the negative effect in eastern WCA 3A by Figure 4-39a,b are not important.

We were also supplied with histograms of 'Wood Stork Foraging Index', 'Great Egret Landscape Abundance', and 'White Ibis Landscape Abundance'. These show percent change in foraging index or in landscape abundance for each year from 1975 through 2005. According to these histograms, both the wood stork and great egret seem to have a substantial number of negative percentage changes, although the white ibis is largely positive. We make some comments on how these histograms were calculated under the 'Fish' section, and our comments there are relevant to the wading birds histograms also.

In my initial review I (NJD) suggested that the mention of enhancing wading bird nesting at the SW coast (ENP) should be removed because the C240 EAA Reservoir could would not produce any benefit based on the model runs for wading birds, or fish or hydroperiods that could increase crayfish production. Based on the presentation and responses of the SFWMD it appears that foraging conditions actually might get slightly worse in southern and SW ENP. If mention of that restoration goal remains in the final technical document then it should be explicit that no substantial benefits or even a slight negative effect can be expected.

Fish:

It was helpful to get follow-up maps from the SFWMD on the individual estimates of fish density for both EARECB and C240. However, the histogram 'Total Fish Density' was at first

confusing, as it shows 'percentage change in total fish density'. Every year in the figure shows positive benefits of C240 to fish, often between 100 and 200 percent and twice over 300 percent. This did not seem reasonable, so we inquired with Dong Yoon. In responses with DLD, he was very helpful in explaining the way that JEM performed the calculations for these histograms. What JEM did was take the difference C240 - Baseline (where Baseline = EARECB) and divide by Baseline for every day of a year in each PSU, then add all these percentages together and average them. We believe that this will bias the result toward those days and PSUs where there was a very low Baseline fish density and a large percentage increase of fish. Because certain regions (e.g., northwest WCA 3A) that initially had low fish densities, will see substantial percentage increases in fish density from C240, whereas other areas that already high Baseline levels may see only modest percentage change, the former will dominate and create high positive percentage gains for every year. Although it is good to see these positive values, we are not sure that it is an important indicator of overall fish (prey) production produced by C240.

On the other hand, the plot of 'Cumulative Small Fish Density', which indicates a steady increase of difference in fish cumulative density between C240 and EARECB, seems to be a good indicator of the improvement for fish under C240. We believe the improvement in the northern WCA 3A and NESRS is substantial and even in average years those areas could experience density increases of 20-50%. Increased production in those places should have substantial effects on prey availability for egrets and storks when fish concentrate in the late dry season.

We assume the wading bird histograms were constructed in the same way as the fish histograms, so we are not sure what weight to give them as indicators of change under C240.

Crayfish:

The responses of crayfish cannot be easily evaluated for the C240 because of the lack of models for evaluation. During the public presentation the District provided some new indications about hydroperiods in the eastern marl prairies and that was helpful. Nevertheless, eastern marl prairies of ENP will have hydroperiods of only 2-4 months with the C240. With such short hydroperiods the benefit to crayfish will be quite limited (Acosta and Perry 2000) except perhaps right near the eastern side of SRS (*P. alleni* production). The positive effect of C240 on crayfish production (*P. fallax*) in northern WCA 3A appear likely based on the hydrological evaluations (i.e., average depths of 1.2 ft) as they were presented in the public meeting; sloughs with shallow-moderate water depths and occasional dry conditions will generally produce higher densities of *P. fallax* (Dorn and Cook 2015; Dorn 2010)

Alligators

Alligator responses to the EAA Reservoir were positive in the original presentation and the public presentation, but systemwide the response suffered from some unexplained negative responses in the SE portion of WCA 3A near the flow-way in an average year. After further evaluation, the presentation of the new hydroperiod map presented on 29 May (slide 35) indicated that the hydroperiods will be somewhat shortened against Tamiami Trail and the

southern part of the L67A. Altogether we found this evaluation encouraging because there is a clear net benefit to the alligator production.

Apple snails

The SFWMD provided additional model output detail during and after the May 29 public presentation. Spatially, the biggest benefits to apple snails of the C240 EAA Reservoir will be seen in NESRS and in northern WCA 3A. From the additional model output, in the form of a histogram of the Adult Apple Snail Population, it appears the annual systemwide increase in projected densities range from ~20%-125% (41% average). The larger increases are projected to come in dry or average precipitation years. However, the histogram is like that of the fish and wading birds; that is, it plots 'percent change in Adults Apple Snail Population' against year, this time from 1995 through 2005, as provided by the EverSnail model. It is likely again that the average will be biased by days and PSUs that have extremely low Baseline (EARECB) values and large percentage increases. This may not be a good indicator of absolute population benefit.

The maps of apple snail numbers for years 1995, 2000, 2002, and 2004 provide a good picture of the differences between EARECB and C240 under different annual conditions. However, some improvements can be suggested towards interpretation of the maps. Ranges of population sizes are given, which are associated with colors. However, what are important for snail kite habitat are the apple snail densities. First, the abundances, which are from the model EverSnail (Darby et al. 2015), are for 400 x 400 m, or 160,000 m^2 pixels. Therefore, from the population ranges given in the figures for apple snail, we can calculate densities. The translations to densities are shown in column 2 of Table 1 (DLD). Estimates of apple snail densities have been linked to estimates of presence and numbers of snail kite nests within 2 km of the sampling site (Cattau et al. 2014). The estimates are given in a graph in their Figure 1B. Rough estimates taken off the graph are given in the third column. According to Figure 2 of Cattau et al. (2014), virtually all those nests would fledge at least one young.

Table 1. Apple snail population size, density, and estimate snail kite nests within 2 km radius of apple snail sampling site.

Population size (apple snails per 400m pixel)	Population density (apple snails per m^2)	Estimated snail kite nests (within 2 km radius of sample)
140,000	0.875	12
120,000	0.75	11
105,000	0.656	10
90,000	0.56	9
75,000	0.46	8
60,000	0.375	7
40,000	0.25	6
30,000	0.1875	4

15,000	0.09375	3

The following interpretations of habitat quality in Table 2 have been suggested by Dr. Stephanie Romañach, USGS (personal communication).

Table 2. Interpretations by Dr. Romañach of effect of apple snail densities on snail kite habitat quality

Category	density ($1/m^2$)	logic
Very good	≥1.2	Interpretation of Cattau et al. 2014
Good	0.4-1.2	Interpretation of Cattau et al. 2014
Fair	0.2-0.4	Interpretation of Darby et al. 2012
Poor	0.1-0.2	Interpretation of Darby et al. 2012
Very poor	<0.1	unsure

The maps of apple snail densities for EARECB and C240 clearly show some differences between the two model outputs. However, it would be useful to try to show better resolution within each of these maps, if possible to be able to show the categories represented in Table 2. The scale bar currently only shows the C240-EARECB difference. More information is available in the data and should be shown in the maps if possible.

Cape Sable Seaside Model

In our (DLD) initial evaluation of the effects of the project on the endangered Cape Sable Seaside Sparrow (CSSS), we noted that the project would have mixed effects on the species population. We note that the public presentations on May 29 and additional information sent afterwards helped clarify the situation.

Figure 4-34 shows that the increased flows into Everglades National Park will have some impacts on the marl prairie habitat of the sparrow. The changes proposed here appears to lower water levels and improve habitat conditions in Subpopulation A, raise water levels to improve habitat conditions in Subpopulations C and F, and minimize impacts to Subpopulations B and E. The proposed changes will affect some of the current habitat positively and some negatively. Some of the positive effects will occur in the habitat of Subpopulation A. This is important, as Subpopulation A has not shown much sign of recovery since a large population decline in the early 1990s.

Subpopulation B currently holds the largest number of sparrows. Along with Subpopulation E it is considered part of the core habitat for the CSSS. It is shown to get very slight positive effect. The greatest positive effects will be to the northeast, in Subpopulations C and F, and importantly, in areas between Subpopulations C and E and C and F. These changes will also increase the connectivity between these three subpopulations.

Some loss in habitat quality will occur north and west of Subpopulation F. This may slightly increase the isolation of Subpopulation A. This may be only a minor effect, however, as there already appears to be little dispersal between Subpopulation A and the other subpopulations. Therefore, the chances of immigration to Subpopulation A will continue to be small, with only a little change. Therefore, the overall effects of the project on the CSSS appears to be positive.

Adaptive management:

The need for flexibility and future adaptive management should be acknowledged explicitly somewhere. It might need its own small section in the document. The original technical document briefly mentioned use of a structure or two (perhaps one on the L67A) that could be used for adaptive management. While it certainly looks like this additional water should provide substantial benefits to the landscape and wildlife and fishes living therein, there remains a significant degree of uncertainty with any model when compared with full reality (i.e., water quality challenges, climate change, plus surprising hydrologic dynamics, habitat shifts, and species responses).

Citations:

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